



SJMLS-2(4)-2017-007

## Prevalence of HIV Infection among Children of HIV Positive Mothers in a Tertiary Health Facility in Maiduguri, Nigeria.

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### Abstract

Mother-to-child transmission of HIV is still a potent means of vertical HIV acquisition in sub-Saharan Africa and Asia with alarming incidences of child mortality. The various intervention programmes introduced for prevention of mother-to-child transmission (PMTCT) require a comprehensive coordinated continuous service with increased access to counseling, accurate testing, anti-retroviral therapy and primary prevention services. This study was carried out to determine the transmission of HIV from HIV positive mothers to their children using immunological and molecular-based techniques. One hundred and forty-four children aged 0 to 20 months born to HIV positive mothers on Anti-Retroviral Therapy (ART) intervention were tested for HIV-1 using Amplicor HIV-1 DNA (version 1.5) and Determine HIV Rapid Test Kits. Fourteen (9.7%) tested positive and 130 (90.3%) were negative. The study revealed a higher prevalence in the age group of 15 months and above with 1 (25%), followed by 6-10 months with 5 (14.7%), and 11-15 months, 3 (10.7%) and the least 0-5 months with 5 (6.4%). The prevalence of HIV was higher among female subjects 12.1% (8) compared to male subjects 7.7% (6). All the 14 HIV positive cases were observed among the 20 children born outside tertiary health facility. Prevalence of mother

to child HIV transmission among children is not influenced by the age and gender of the subjects studied or by mothers' occupation but the intervention received by pregnant HIV positive mothers. ART started before pregnancy is enormously effective in preventing mother to child transmission. Literacy of mothers also plays a role in seeking intervention after awareness

**Key Words:** HIV-Infection, Children, HIV-positive, mothers.

### Introduction

The transmission of HIV from a HIV-positive mother to her child during pregnancy, labor, delivery or breastfeeding is called mother-to-child transmission (MTCT). It is rated the second most common means of HIV transmission in most African countries and the largest cause of HIV infection in children (WHO, 2010). In the absence of any intervention, transmission rates range from 15% to 45% (WHO, 2015), due to a mélange of

factors including breastfeeding, high maternal viral load, advanced maternal immune deficiency and prolonged rupture of membranes (De Cock *et al.*, 2000). This rate can be reduced to below 5% with effective interventions during the periods of pregnancy, labour, delivery and breastfeeding (Nguyen *et al.*, 2013). These interventions primarily involve antiretroviral treatment for the mother and a short course of antiretroviral drugs for the baby. They also include measures to prevent HIV acquisition in the pregnant woman and appropriate breastfeeding practices. However, effective Prevention of Mother to Child Transmission (PMTCT) programmes require women and their infants to have access to – and take up a cascade of interventions including antenatal services and HIV testing during pregnancy; use of antiretroviral treatment (ART) by pregnant women living with HIV; safe childbirth practices and appropriate infant feeding; uptake of infant HIV testing and other post-natal healthcare services (Padian *et al.*, 2011).

The World Health Organization (WHO) promotes a comprehensive approach to PMTCT Programmes which includes the four (4) cardinal points of (i) preventing new HIV infections among women of childbearing age (ii) preventing unintended pregnancies among women living with HIV (iii) preventing HIV transmission from a woman living with HIV to her baby (iv) providing appropriate treatment, care and support to mothers living with HIV and their children and families (WHO, 2010).

In 2016, UNAIDS with PEPFAR among others launched Start Free, Stay Free, AIDS Free – a framework calling for a worldwide sprint towards “super fast-track targets” to end AIDS among children, adolescents and young women by 2020. Targets relating to PMTCT include reducing the number of new HIV infections

among children to fewer than 40,000 by 2018 and fewer than 20,000 by 2020. There is also a commitment to ensure that 95% of pregnant women living with HIV are receiving lifelong HIV treatment by 2018 (UNAIDS, 2016).

Between 2009 and the end of 2015, there was a 60% decline in new HIV infections among children in the Global Plan priority countries, from 270,000 to 110,000, equating to 1.2 million averted infections. This compares to a fall of just 24% between 2000 and 2008, meaning that the rate of the decline in new infections since the launch of the Global Plan nearly tripled. Without Nigeria, the remaining countries reduced new HIV infections by 69%<sup>6</sup>. Other countries still face significant challenges to rolling out effective PMTCT services. Angola, Cote d’Ivoire and Nigeria have registered a less than 40% reduction in new HIV infections among children since 2009 (UNAIDS 2016). One study from South West Nigeria recorded that while 99.8% of pregnant women were aware of HIV and had very high knowledge of MTCT (92%) and PMTCT (91%), a significant number (71%) had negative views towards PMTCT. This was due to factors such as stigma and discrimination (Olugbenga-Bello *et al.*, 2013).

Previous study in Maiduguri, North-Eastern Nigeria reported high maternal sero-prevalence and MTCT infection (Kullima *et al.*, 2015). This may be due to low literacy level, poor knowledge of MTCT and PMTCT complicated by stigma and discrimination. This study is designed to determine the prevalence of HIV infection among children of HIV-positive mothers in a tertiary health facility in Maiduguri, Nigeria using Dried-Blot-Spots (DBS) Polymerase Chain Reaction (PCR) technique.



## Methodology

**Study design:** This descriptive cross-sectional prospective study was conducted in 2016

**Study Area:** This study was carried out at the University of Maiduguri Teaching Hospital (UMTH), Maiduguri, Nigeria. UMTH is a major referral medical center in the North-Eastern Nigeria, with 500 bed size and sub-specialties in medicine and training of other health care professionals. Maiduguri is the capital of Borno state, which lies on latitude 115°N and longitude 135°E, and occupies an area of 50,778 square kilometers.

## Study Subjects

The subjects of this study were children aged 0-20 months of age born of HIV-positive mothers.

**Ethical Considerations:** Approval for the study was sought from the Ethical Committee of the University of Maiduguri Teaching Hospital, Maiduguri. Written informed consent was obtained from the parent of each study subject after explanation of the objectives and the procedures of the study. Confidentiality was ensured by coding the questionnaires.

## Sample Collection

### Collection of Dried Blood Spots (DBS) from Infants for PCR Testing.

Sample collection was carried out as described in AIDS Preventive Initiative Nigeria Guideline (2003). After necessary preparations, the area to be pricked was chosen and the mother of the baby was asked to warm the area. The area

varies according to the age and weight or size of the baby; Infants 6 weeks to 4 months (heel), Infants 4 to 10 Months (big toe), Infants >10 Months or 10 kg (finger). The baby was positioned with the foot or hand down, the site to be pricked was disinfected using fresh alcohol swab, and allowed to dry for 30 seconds. Gently squeeze and release the area to be pricked until it is ready to be bled then prick the infant in the selected spot with the 2mm lancet. Wipe away the first spot of blood, and then allow a large drop of blood to be collected. Touch the filter paper (Whatman 903) gently against the large drop and allow it to completely fill the circle. Collect at least 3 good drops aiming to completely fill all the 5 circles. Clean the area, no bandage is needed.

### Sample Extraction, Reagents Preparations and Amplification and Detection of HIV-1

The samples were extracted, reagents prepared, amplified using Applied Biosystems GeneAmp PCR System 9600 as described by the manufacturer Roche Molecular Systems Inc., Branchburg, USA. The Amplicor HIV-1 DNA test version 1.5 was used for testing following the manufacturer's standard operating procedure. The principle is based on five major processes: specimen preparation; reverse transcription or target RNA to generate complementary DNA (cDNA); PCR amplification of target cDNA using HIV-1 specific complementary primers; hybridization of the amplified products to oligonucleotide probes specific to the target(s); and detection of the probe-bound amplified products by colorimetric determination. Table 1 shows the results validation and interpretation.

**Table 1: Results Validation and Interpretation**

HIV-1	Result	IC Result	Interpretation
<b>A450</b>		<b>A450</b>	
	< 0.2	≥ 0.2	<b>HIV-1 DNA not detected.</b> Sample is negative for HIV-1 DNA
	< 0.2	<0.2	<b>Inhibitory Sample.</b> HIV-1 DNA, if present will not be detected, repeat testing
	≥ 0.8	ANY	<b>HIV-1 DNA Detected.</b> Sample is positive for the presence of HIV-1 DNA
	≥ 0.2, < 0.8	ANY	Equivocal. Results are inconclusive for HIV-1 DNA. Duplicate and repeat testing.

**Retesting:** If retesting is required, repeat testing was performed on the specimen. The final interpretation of these specimens should be

determined using 0.2 OD cut off as shown in table 2. As indicated in the table below.

**Table 2: Final interpretation of specimens determined using 0.2 OD cut off**

Repeat HIV-1 Results	Repeat IC Results	Interpretation
<b>A450</b>	<b>A450</b>	
At least 1 result > 0.2	Any value	<b>HIV-1 DNA detected.</b> Sample is positive for HIV-1 DNA
Both results < 0.2	Both results > 0.2	<b>Sample is negative for HIV-1 DNA</b>
Both results < 0.2	At least 1 result <0.2	<b>Invalid result.</b> Sample indeterminate for HIV-1 DNA

If result is invalid (HIV-1OD < 0.2 and IC OD < 0.2), re-amplify and re-detect. If still invalid, process and test a different DBS disc.

**Results**

Total DBS samples of 144 children aged 0-20 months were analyzed. Table 3 shows the demographic characteristics of the study population. The largest proportion 78 (54.2%) of the study population were below the age of 0-5 months while the least proportion were 4(2.8%) were above the age of 15 months. The number of males tested 78 (54.2%) was larger than that of females 66 (45.8%). A total of 124 (84%) were delivered in the UMTH while 20

(13.9%) were delivered outside UMTH. The study also showed that 141 (97.9%) of the HIV-positive mothers were married and 3 (2.1%) were single. Fulltime housewives made up 84.0%, teachers 5.6%, traders 5.6% and civil servants 8.3% of the HIV-positive mothers. Table 4 showed that most of the DBS samples tested (n=78) were from children of 0-5 months of age while the least number (n=1) was from children of >15 months of age. The percentages of PCR positive sample were influenced by the



number of DBS samples tested in the individual age groups. The number of male children (n=78) enrolled in the study was slightly greater than the females (n=66), as shown in table 5. Of the infected population, females accounted for 8 (57.2%) while males accounted for 6 (42.7%). Table 6 showed that all the infected children

were from HIV-positive mothers who did not receive ART intervention before or during pregnancy. Table 5 showed all the PCR positive DBS (n=14) were from children born of mothers who were fulltime housewives and not teachers, civil servants, traders/business women.

**Table 3: Demographic characteristics of the study population**

Age Group (Months)	Number of Tested DBS (n)	Percentage (%)
0-5	78	54.2
6-10	34	23.6
11-15	28	19.4
>15	4	2.8
<b>Total</b>	<b>144</b>	<b>100</b>
<b>Gender</b>		
Male	78	54.2
Female	66	45.8
<b>Total</b>	<b>144</b>	<b>100</b>
<b>Mother's Marital Status</b>		
Married	141	97.9
Single	3	2.1
Divorced	0	0.0
<b>Total</b>	<b>144</b>	<b>100</b>
<b>Mother's Occupation</b>		
FH	121	84.0
Traders/Business	3	2.1
Teachers	8	5.6
Civil Servants	12	8.3
<b>Total</b>	<b>144</b>	<b>100</b>
<b>Child's Place of Birth</b>		
UMTH	124	86.1
Outside UMTH	20	13.9
<b>Total</b>	<b>144</b>	<b>100</b>

**Legend: FH= Fulltime Housewives**

**UMTH= University of Maiduguri Teaching Hospital**

**Table 4: Prevalence of HIV among children born of HIV-positive mothers according to age in University of Maiduguri Teaching Hospital.**

Age Group (Months)	PCR Positive [Number (%)]	PCR Negative [Number (%)]	Number of Samples Tested
0-5	5 (6.4)	73 (93.6)	78
6-10	5 (14.7)	29 (85.3)	34
11-15	3 (10.7)	25 (89.3)	28
>15	1 (25.0)	3 (75.0)	4
<b>Total</b>	<b>14 (9.7)</b>	<b>130 (90.3)</b>	<b>144</b>

PCR: Polymerase Chain Reaction

**Table 5: Prevalence of HIV among children born of HIV-positive mothers according to gender in University of Maiduguri Teaching Hospital.**

Gender	PCR Positive [Number (%)]	PCR Negative [Number (%)]	Number of Samples Tested
Male	6 (7.7)	72 (92.3)	78
Female	8 (12.1)	58 (87.9)	66
<b>Total</b>	<b>14 (9.7)</b>	<b>130 (90.3)</b>	<b>144</b>

**Table 6: Prevalence of HIV among children born of HIV-positive mothers based on types of intervention received by the mothers.**

Type of intervention received by mother	PCR		Total
	Result Positive (n)	Negative (n)	
HAART during pregnancy	0	16	16
HAART before pregnancy	0	114	114
No intervention received	14	0	14
<b>Total</b>	<b>14</b>	<b>130</b>	<b>144</b>

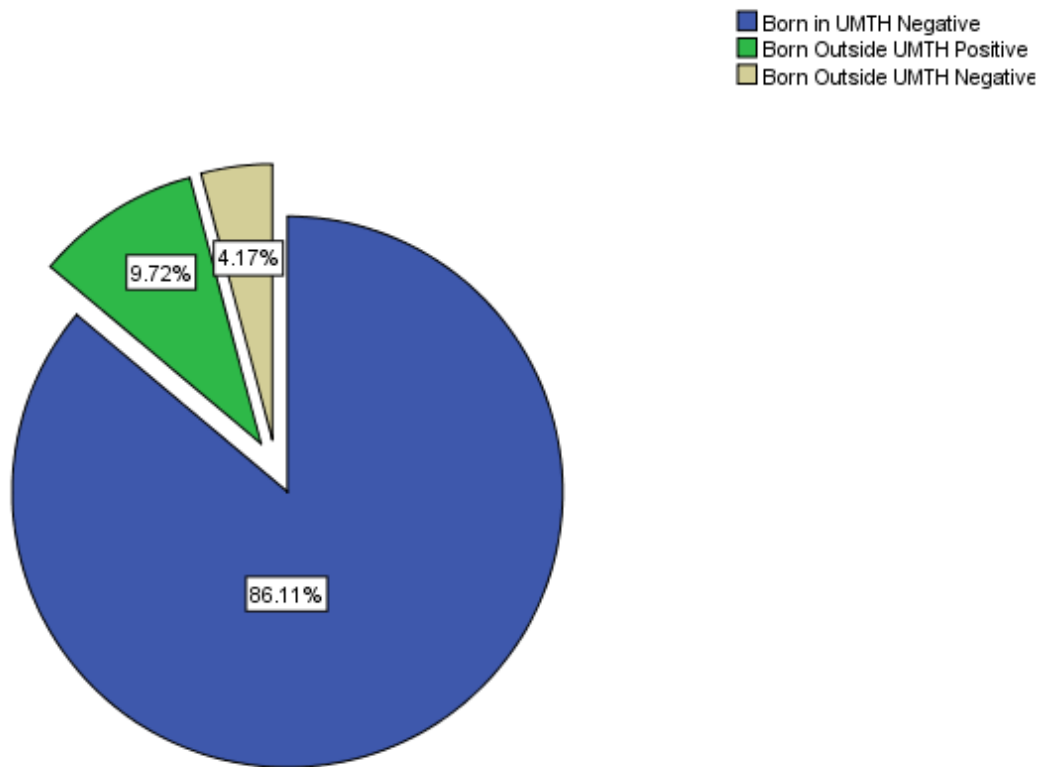


**Table 7: Distribution of HIV among children born of HIV-positive mothers based on mother’s occupation.**

Mother’s occupation	PCR Positive [Number (%)]	PCR Negative [Number (%)]	Number of Samples Tested
Civil servants	0 (0.0)	12 (100.0)	12
FH	14(11.6)	107 (88.4)	121
Teachers	0 (0.0)	8 (100.0)	8
Traders/business	0 (0.0)	3 (100.0)	3
<b>Total (n)</b>	<b>14</b>	<b>130</b>	<b>144</b>

**FTHW:** Fulltime housewives

**Prevalence of MTCT of HIV by place of birth**



**MTCT=** Mother to child transmission

**UMTH=** University of Maiduguri Teaching Hospital

**Figure 1: Prevalence of MTCT of HIV Based on Place of Birth**



## Discussion

Annually, an estimated number of 1.4 million women living with HIV become pregnant, globally. In the absence of any intervention, transmission rates of HIV to their children range from 15% to 45% during pregnancy, labour, delivery or breastfeeding (WHO, 2015). This rate can be reduced to below 5% with effective interventions during the periods of pregnancy, labour, delivery and breastfeeding (Nguyen *et al.*, 2013). These interventions include antenatal HIV screening, ART therapy for HIV-positive expectant mothers and testing and monitoring of children born of HIV-positive mothers. This study was designed to determine the prevalence of HIV infection among children of HIV-positive mothers in a tertiary health facility in Maiduguri, Nigeria using Dried-Blot-Spots (DBS) Polymerase Chain Reaction (PCR) technique.

Out of 144 DBS sample of children born of HIV-positive, 14 (9.7%) tested positive for HIV. This percentage was high compared to lesser percentages obtained from the developed economies where PMTCT is most paramount. Our study showed 0% MTCT among HIV-positive mothers who received HAART intervention before and during pregnancy. This is an indication of 100% achievable prevention of vertical HIV transmission when PMTCT is fully implemented. This is in agreement with previous study by Kullima *et al.* (2016). However, the 9.7% MTCT occurred among HIV-positive mothers who did not receive any intervention. Mechanisms of perinatal transmission from HIV-positive mothers to their children have well been documented. Access and enrollment of HIV-positive mothers in PMTCT and successful completion are affected by several factors most of which are socioeconomic and cultural in nature (Merga *et*

*al.*, 2016). In recent time, Nigeria has recorded significant progress in providing PMTCT services, both in delivery of more efficacious PMTCT interventions and increase in proportion of women accessing the intervention. A study from South West Nigeria showed that 99.8% of pregnant women were aware of HIV and had very high knowledge of MTCT (92%) and PMTCT (91%) but 71% of them still holds negative views towards PMTCT (Olugbenga-Bello *et al.*, 2013). Fear of unintended disclosure, if receiving PMTCT care identifies them as HIV-positive mother which could lead to stigmatization by the community has been identified as one of the key barriers to seeking care for themselves and the HIV-exposed infants (Merga *et al.*, 2016; Olugbenga-Bello *et al.*, 2013).

Most (84%) of the HIV-positive mothers in our study were full-time housewives while the least (2.1%) were traders/business women. Notwithstanding, previous report suggested that mother to child HIV transmission among children is not influenced by the age and gender of the subjects studied or by mothers' occupation while other differs (Merga *et al.*, 2016; Fentaw *et al.*, 2014).

The WHO guidelines provide a background to the PMTCT problem in the world, in Africa and Nigeria and also give details on HIV in pregnancy, the transmission patterns of MTCT and describe the benefits of preventing mother-to-child transmission (PMTCT). They also provide information on interventions necessary to reduce MTCT that include counseling and testing, WHO staging, laboratory investigations, obstetric interventions, early infant diagnosis (EID) and ARV prophylaxis or treatment (ART) for the HIV infected woman and her family. The advantages of the PMTCT include; Reduction of MTCT of HIV, decrease in the





numbers of HIV infected children, improved child health and survival, decreased load on the health system and facilitates an opportunity to improve and expand health services as well as to strengthen the existing health infrastructure.

### Conclusion/Recommendations

The prevalence of mother to child HIV transmission among children is not influenced by the age and gender of the subjects studied or by mothers' occupation but the intervention received by the pregnant HIV positive mothers. ART started before pregnancy is enormously effective in preventing mother to child transmission. This study calls for proper delivery, optimum manpower and facility development in the grassroots level and promotion of proper awareness in local dialects. The PMTCT should not only target vertical transmission from mother to child alone but horizontal transmission also.

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**Citation:** Oderinde, B.S., Agbede, O.O., Mshelia, J.U., Medugu, J.T., Solomon, A.I., Bukbuk, D.N., Oku, E.I., Oderinde, A.F. Prevalence of HIV Infection among Children of HIV Positive Mothers in a Tertiary Health Facility in Maiduguri, Nigeria. *Sokoto Journal of Medical Laboratory Science*;2(4): 53 – 62.

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